

TRANS-OCEANIC INSECT DISPERSAL

1. Trapping and collecting on ships in the South Pacific Ocean, 1974-1979

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Abstract. An introduction to this series mainly covers the Bernice P. Bishop Museum, Honolulu, projects on arthropod dispersal, 1957-1970. Continuation of these studies from the Auckland Museum started with collecting on ships at sea since 1965 and ship-board trapping in the South Pacific area in 1969.

Part I of the series records net-trapping on ships during regular return voyages from New Zealand through Fiji, Samoa and Tonga in the South Pacific Ocean. Trapping and collecting on 29 voyages between 1974 and 1979 are reported. Tables and maps of successful net runs and collections are included. Voyages are compared and preliminary insect and other arthropod results noted.

In the late 1950s and early 1960s, the late J. Linsley Gressitt, of Entomology Department, Bernice P. Bishop Museum, Honolulu, began investigating wind-borne insects by trapping on ships and with aircraft in the Pacific Ocean and Antarctic areas. Subsequently, trapping was also done on ships in the Atlantic and Indian Oceans and on land in Antarctica, on subantarctic islands and in northern Alaska as part of trans-oceanic arthropod dispersal studies.

Antarctic and subantarctic trapping so far reported continued until 1966 and in the Pacific and other areas until 1970.

Results of trapping and collecting on ships in the Pacific area, 1957-1970, have been recorded in a numbered series of papers by Gressitt & Nakata (1958), Yoshimoto & Gressitt (1959, 1960, 1961), Harrell & Yoshimoto (1964), Harrell & Holzapfel (1966), Holzapfel & Perkins (1969), Guilmette, Holzapfel & Tsuda (1970) and Holzapfel, Clagg & Goff (1978). All these records were for the North Pacific area except for a few collections made on two ship passages which included Samoa (Holzapfel & Perkins (1969), Society Is and further south, and the Galapagos Is (Holzapfel, Clagg & Goff 1978). Concurrent trapping for smaller organisms, which produced some arthropod specimens, was also done on three voyages between 1967 and 1970 (Kramer, Wartell & Holzapfel 1973).

Trapping results from two other ship expeditions were also reported per the Bishop Museum project. During the round-the-world 'Galathea' Expedition, 1950-1952 (Yoshimoto, Gressitt & Wolff 1962), successful trapping had been done throughout the whole cruise including catches around New Zealand and in the South and North Pacific. Catches were also made in the North Pacific, South Pacific and in the New Zealand area during the 'Monsoon' Expedition, 1960-1961 (Gressitt, Coatsworth & Yoshimoto 1962).

Two numbered papers on trapping in the Pacific-Antarctic area (Yoshimoto, Gressitt & Mitchell 1962, Yoshimoto & Gressitt 1963) included results from ship-board trapping on North and South Pacific voyages and south of New Zealand. The first of three papers on trapping in the Antarctic area (Gressitt, Leech & O'Brien 1960) gave results from ship-board trapping between New Zealand and Antarctica and around the continent to South America in the 1959-60 Antarctic summer season. Net trapping was also done with small aircraft and on the ground in the Ross Sea sector of Antarctica in the same season. A second paper (Gressitt, Leech, Leech, Sedlacek & Wise 1961) recorded net trapping in the 1960-61 season on ships south of Australia, New Zealand and South America and on land in the Ross Sea and Antarctic Peninsula sectors.

During the course of a separate project by Madison E. Pryor, of University of Tennessee, U.S.A., trapping for air-borne arthropods on land in the Ross Sea sector of Antarctica had also been done in the 1959-60 season (Pryor 1962).

Further trapping on ships and on land in Antarctica between the 1959-60 and 1961-62 seasons was noted by Gressitt, Leech & Wise (1963).

Dispersal studies for the Bishop Museum project were extended to the Atlantic area in 1962 by ship-board trapping on a United States Antarctic survey ship (Holzapfel, Tsuda & Harrell 1970) and on British Antarctic Survey ships from 1962 to 1965 (Clagg 1966).

A third paper on trapping in Antarctica (Holzapfel, Tsuda & Harrell 1970) contained results of ship-board trapping on many voyages south of New Zealand and South America from 1963 to 1966 and also on Atlantic, South Pacific and Indian Ocean voyages from 1962 to 1965.

Net trapping on land in relation to trans-oceanic dispersal was also carried out on two subantarctic islands, Campbell I, 1961-62 (Gressitt 1964b) and South Georgia, 1962-64 (Gressitt 1970).

Further dispersal studies by net trapping were made north of the Arctic Circle in northern Alaska in the Arctic summers of 1966 and 1969 (Gressitt & Yoshimoto 1974).

A high speed trap developed for use on large aircraft was first used in the 1960-61 Antarctic season (Gressitt, Sedlacek, Wise & Yoshimoto 1961) on flights between Antarctica and the east coast of the United States, via New Zealand and Honolulu, and subsequently over the North Pacific Ocean. Results of flights, including North America/Antarctica and also North Pacific flights, from 1960 to 1963, were reported by Holzapfel & Gressitt (1965). Final results covering use of this trap over the North Pacific Ocean and the United States from 1966 to 1969 were given by Holzapfel (1978). Concurrent trapping for smaller organisms was also done with this trap in 1968-69 (Kramer & Holzapfel 1973).

An overall discussion on Bishop Museum trans-oceanic dispersal studies in the 1957-1966 period was published by Holzapfel & Harrell (1968).

The dispersal studies and results have supplied more data towards the understanding of trans-oceanic arthropod movement and distribution. J.L. Gressitt assessed the information in many biogeographical discussion papers (Gressitt 1961, Gressitt & Yoshimoto 1963, Gressitt 1964, 1965a, 1965b, 1967, 1970, 1974).

Identifications of some of the arthropod specimens trapped and collected during the Bishop Museum dispersal studies have been recorded and discussed separately (Thornton 1964, Yoshimoto & Gressitt 1964, Thornton & Harrell 1965, Yoshimoto & Gressitt 1965, Scudder 1968, Forster 1971, Zimmerman 1975). In a summary to the Insects of Campbell Island Monograph, Gressitt (1964b) listed identified species of insects taken in net traps on Campbell I, but only a few of these are recorded as such in the taxonomic papers in the Monograph.

From 1965, when the present author took up his current position in the Auckland Museum, his interest in insect dispersal was continued with the assistance of a keen bird-watcher, J.A.F. Jenkins, who was then a deck officer on ships sailing from New Zealand ports. Jenkins collected insects for the Auckland Museum at various overseas ports on western routes to Australia and India and in the Pacific Islands while also, by request, watching for, collecting and recording insects at sea.

In 1969, net trapping was done for the author during the Royal Society of New Zealand Cook Bicentenary Expedition in the South Pacific, 1969, and the results of trapping and collecting on *HMS Endeavour* were recorded (Wise 1971).

However, all the collecting on ships at sea had been sporadic, using ships on various routes at various times just as and when they became available and when passage for collectors could be obtained. Consequently, in 1974, when Jenkins (now Captain) offered to start net trapping as often as possible on regular shipping runs in the South Pacific he presented an opportunity for comparable sampling over a longer period. Further, the route to and from the Pacific Islands was northerly and southerly, as well as being amongst some of the island groups, giving an opportunity to test the effect of easterly tradewinds in the tropics against the general west-east drift.

Information presented here is the result of trapping and collecting on ships at sea during 29 voyages in the period 1974-1979.

SOUTH PACIFIC OCEAN, 1974-1979

METHODS

Union Shipping Company voyages are numbered for each vessel and these voyage numbers are used here. Captains are in command of vessels for several voyages at a time then are replaced for several, hence the intermittent voyage numbers which appear in the records. Captain Jenkins flew nets on most of his voyages and consecutive sample numbers were used through each group of voyages. The voyages were made on regular triangular courses, as indicated in Fig. 1, beginning and ending at Auckland, New Zealand, and proceeding through Fiji, Samoa and Tonga.

The voyages reported on here are listed in Table 1, together with numbers of net runs, net samples, net runs with specimens, collected specimens and some percentages. It is seen that a large number of net runs were made and large numbers of samples taken (92.87% in all). Of these a little less than half contained arthropod specimens (43.51% of net runs, 46.85% of net samples).

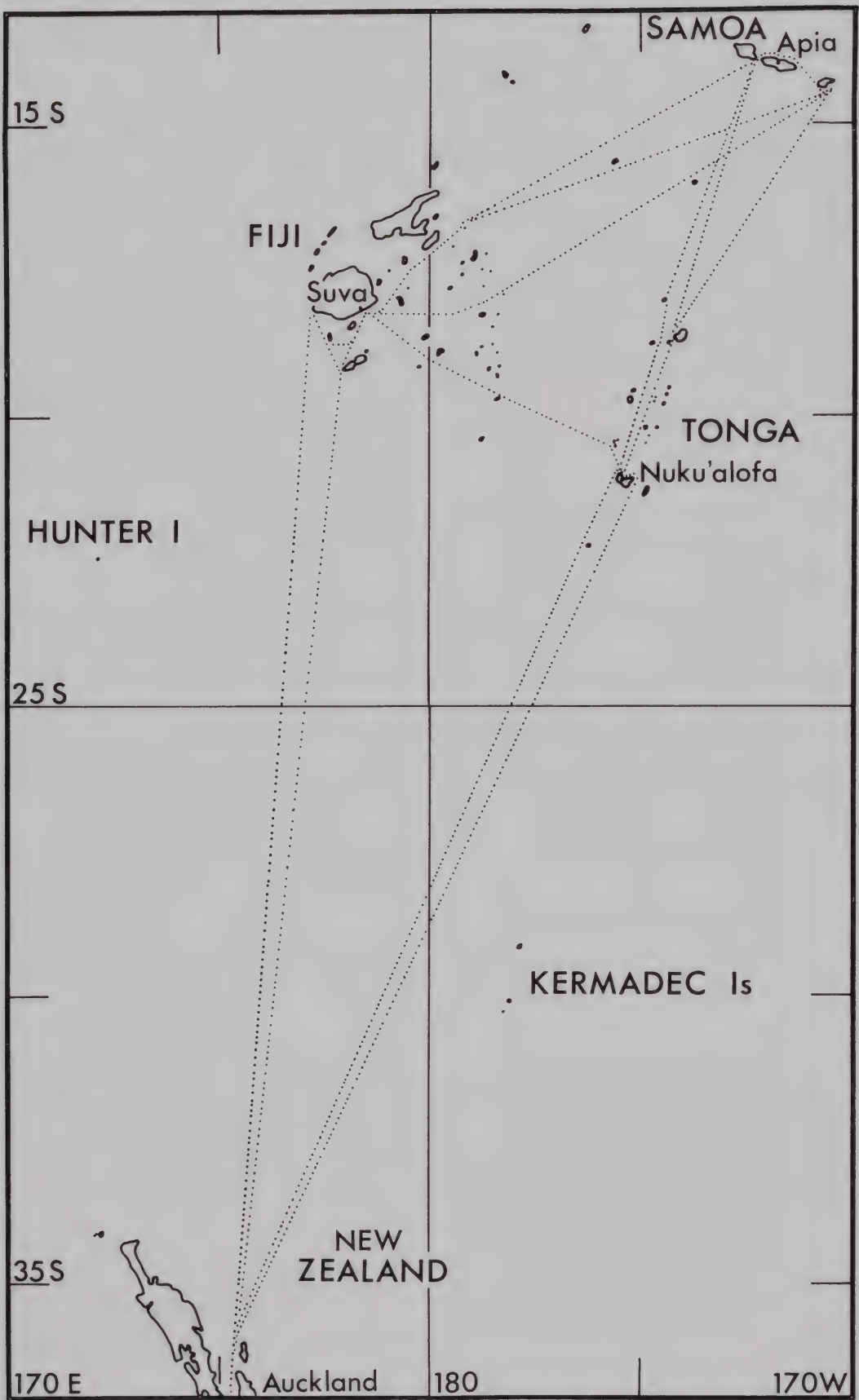


Fig. 1. Routes of ships on Pacific Islands voyages.

Table 1. Net runs, samples and collections on *Union South Pacific* and *Marama* voyages, 1974-1979.

Years	Voyages	No of net runs	Numbered net samples	% net runs with samples	No of net runs with specimens	% net runs with specimens	% samples with specimens	Numbered hand collections	Unnumbered hand collections	Total hand collections
1974	USP 19	22	8	36.36	6	27.27	75.00	2	1	3
	USP 20	12	4	33.33	2	16.66	50.00		1	1
	USP 28	23	23	100.00	12	52.17	52.17	1		1
	USP 31	20	19	95.00	11	55.00	57.89	7		7
1974-1975	USP 32	20	21 †	100.00	13	65.00	61.90	2		2
1975	USP 35	16	14	87.50	5	31.25	35.71			
	USP 36	13	12	92.30	3	23.07	25.00			
	USP 39	18	17	94.44	8	44.44	47.05	2		2
	USP 40	16	16	100.00	7	43.75	43.75		1	1
1978	M 1	18	18	100.00	11	61.11	61.11		2	2
	M 4	9	9	100.00	3	33.33	33.33	1		1
	M 5	4	4	100.00	1	25.00	25.00			
	M 6	14	14	100.00	9	64.28	64.28		2	2
	M 10	15	15	100.00	3	20.00	20.00			
	M 11	15	15	100.00	7	46.66	46.66			
	M 12	13	13	100.00	3	23.07	23.07			
	M 13	6	5	83.33	2	33.33	40.00			
	M 15 ‡								1	1
	M 17 ‡								1	1
1978-1979	M 24	17	17	100.00	9	52.94	52.94			
1979	M 25	19	19	100.00	13	68.42	68.42			
	M 30	11	11	100.00	10	90.90	90.90			
	M 31	14	14	100.00	6	42.85	42.85			
	M 32	4	3	75.00	2	50.00	66.66			
	M 37	11	11	100.00	4	36.36	36.36			
	M 38	16	16	100.00	6	37.50	37.50		1	1
	M 42	24	24	100.00	11	45.83	45.83			
	M 43	4	4	100.00	1	25.00	25.00			
	M 46	19	19	100.00	3	15.78	15.78		1	1
	Totals % of totals	29	393	365	92.87	171	43.51	46.85	15	11

† Two numbered samples were taken from one net run ‡ Collections made for J. A. F. Jenkins who was not on board for these voyages

The nets used were similar to those used previously (Yoshimoto & Gressitt 1960, Wise 1971), being fine fabric cones on steel rings 75 cm in diameter; usually flown four or more at a time. Sample numbers were given when samples were taken from nets but collected specimens were sometimes numbered and sometimes not.

In the Museum all samples have been sorted under a microscope and those containing arthropod material stored in alcohol, except for the occasional large insect, such as a moth, which was pinned. Printed labels indicating ship, voyage and sample have been added together with other relevant data.

The data presented here in tables (Tables 2-30) and maps (Figs. 2-25) only include information concerning successful net runs (that is, when the samples taken were found to contain arthropod material) and hand collected specimens. Data presentation in tables is in much the same format as in all previous papers. However, it is considered worthwhile to include here maps for all the voyages in the present series to show the extent of successful net runs and collections, and the recurring mid-oceanic catches. The maps will also enable comparison of catch runs voyage by voyage and month by month and, in due course, of occurrences of various families or species of Arthropods.

As identification of all insect and other arthropod material is still in progress, the specimen records are given here only in general terms. It is intended to present information on species and possible sources of specimens in later parts of this series.

RESULTS

In the first year of the series, 1974, samples were taken during net trapping on five voyages of the *Union South Pacific* (USP 19, 20, 28, 31, 32 [part], Tables 2-6, Figs. 2-6). Many successful net runs were made, mostly near New Zealand and amongst the Pacific Islands.

There were five *Union South Pacific* voyages when samples were taken in 1975 (USP 32 [part] 35, 36, 39, 40, Tables 6-10, Figs. 6-10), but USP 32 samples were negative. Most successful net runs were amongst the Pacific Islands but there were also some mid-oceanic catches.

No net trapping was done in 1976 and 1977.

Trapping was resumed on the ship *Marama* in 1978, when samples were taken on nine voyages (*M* 1, 4, 5, 6, 10, 11, 12, 13, 24 [part], Tables 11-18, 21, Figs. 11-16, 18). Successful net runs were again mostly amongst the Pacific Islands but several were mid-oceanic and some near New Zealand.

Finally, in 1979, there were ten successful voyages for samples on the *Marama* (*M* 24 [part], 25, 30, 31, 32, 37, 38, 42, 43, 46, Tables 21-30, Figs. 18-25). Most of the successful net runs were mid-oceanic and amongst the Pacific Islands.

Monthly comparisons

Over the whole period, samples with specimens were taken in each month except November, indicating wind dispersal during the mid-year southern winter, as well as in the summer.

For comparison, the voyages are here listed for the months in which they were made.

January	<i>M</i> 1 (Table 11, Fig. 11), <i>M</i> 24 [part] (Table 21, Fig. 18), <i>M</i> 25 (Table 22, Fig. 19).
February	<i>USP</i> 35 [part] (Table 7, Fig. 7).
March	<i>USP</i> 35 [part] (Table 7, Fig. 7), <i>USP</i> 36 (Table 8, Fig. 8), <i>M</i> 4 (Table 12, Fig. 12), <i>M</i> 5 (Table 13, Fig. 12), <i>M</i> 6 [part] (Table 14, Fig. 13).
April	<i>M</i> 6 [part] (Table 14, Fig. 13), <i>M</i> 30 (Table 23, Fig. 20), <i>M</i> 31 [part] (Table 24, Fig. 21).
May	<i>USP</i> 19 (Table 2, Fig. 2), <i>USP</i> 20 (Table 3, Fig. 3), <i>USP</i> 39 (Table 9, Fig. 9), <i>USP</i> 40 (Table 10, Fig. 10), <i>M</i> 31 [part] (Table 24, Fig. 21), <i>M</i> 32 (Table 25, Fig. 21).
June	<i>M</i> 10 (Table 15, Fig. 14), <i>M</i> 11 (Table 16, Fig. 15).
July	<i>M</i> 12 (Table 17, Fig. 16), <i>M</i> 13 (Table 18, Fig. 16), <i>M</i> 37 (Table 26, Fig. 22).
August	<i>M</i> 15 (Table 19, Fig. 17), <i>M</i> 38 (Table 27, Fig. 23).
September	<i>M</i> 17 (Table 20, Fig. 17), <i>M</i> 42 [part] (Table 28, Fig. 24).
October	<i>USP</i> 28 (Table 4, Fig. 4), <i>M</i> 42 [part] (Table 28, Fig. 24), <i>M</i> 43 (Table 29, Fig. 24).
November	Nil.
December	<i>USP</i> 31 (Table 5, Fig. 5), <i>USP</i> 32 (Table 6, Fig. 6), <i>M</i> 24 [part] (Table 21, Fig. 18), <i>M</i> 46 (Table 30, Fig. 25).

ARTHROPOD DISPERSAL

The samples with specimens and the hand collections are recorded below in several categories. These categories have been arbitrarily chosen to give some indication of the importance of the arthropod specimens in regard to trans-oceanic dispersal.

Net trapped mid-ocean

The whole net run was 45 n.ml. or more from land.

USP 19: 1. *USP* 20: B, D. *USP* 28: 2, 17, 20. *USP* 31: 1, 2, 5, 7, 25. *USP* 32: 27, 28, 30. *USP* 35: 8A. *USP* 36: 18. *USP* 39: 1, 17. *USP* 40: 19, 21, 23, 29, 31. *M* 1: 1, 2, 3, 4, 8. *M* 6: 15, 16, 17, 18, 25. *M* 13: 44. *M* 24: 1, 3, 5, 15. *M* 25: 19, 31, 34, 35. *M* 30: 1, 2, 3, 4, 5, 6, 9. *M* 31: 13, 14, 15, 24. *M* 37: 1, 3, 8. *M* 38: 12, 13, 14, 16, 25, 26. *M* 42: 1, 4, 5, 7, 21, 22. *M* 43: 25. *M* 46: 16.

Net trapped at sea/off shore (Pacific Islands)

One end of the net run was within 45 n.ml. of the shore of one or more of the islands, or the whole run was amongst Pacific Islands.

USP 19: 2, 5, 6, 7, 8. USP 28: 6, 7, 10, 11, 12, 13, 14, 16. USP 31: 8, 10, 13, 17, 18.
USP 32: 34, 35, 36, 37, 38, 39, 44. USP 35: 5, 6, 7, 8. USP 36: 19, 20.
USP 39: 5, 9, 10, 11, 12, 13. USP 40: 25, 28. M 1: 6, 7, 10, 12. M 4: 1, 3, 4.
M 6: 23, 24, 29, 31. M 10: 6, 10, 11. M 11: 18, 19, 21, 22, 23, 24, 25. M 12: 38,
39, 40. M 13: 48. M 24: 6, 8, 10, 12. M 25: 24, 25, 26, 27, 28, 29, 30. M 30:
7, 8, 10. M 31: 20, 23. M 32: 26, 27. M 37: 5. M 42: 10, 12, 18, 19, 20.
M 46: 9, 14.

Net trapped at sea/off shore (New Zealand)

One end of the net run was within 45 n.ml. of the New Zealand coast and off shore islands.

USP 28: 23. USP 32: 26. M 1: 18. M 5: 10. M 24: 17. M 25: 18, 36.

Net trapped in harbour (Pacific Islands)

On a few occasions nets were flown within a harbour and emptied before leaving.

USP 31: 19. USP 32: 42, 43. M 1: 13.

Collected mid-ocean

Winged specimens, some taken alive, collected 45 n.ml. or more from land.

USP 31: 3, 6. USP 39: 15A.

Collected at sea/off shore (Pacific Islands)

Winged specimens taken within 45 n.ml. of the shore.

USP 31: 9, 15. USP 32: 40. M 4: 3. M 6: 1 collection. M 15: 1 collection.
M 17: 1 collection

Collected in harbour (Pacific Islands)

Winged specimens taken aboard ship in harbour.

USP 20: 1 collection. USP 31: 15. USP 40: 1 collection. M 1: 2 collections.
M 6: 1 collection. M 38: 1 collection. M 46: 1 collection.

Collected in harbour or after harbour visit (Pacific Islands)

Wingless specimens or others which appeared to be cargo associated.

USP 19: 3, 4, 1 collection. USP 28: 7A. USP 31: 12, 23. USP 32: 29. USP 39: 6.

Table 2. *Union South Pacific Voyage No. 19* (J.A.F. Jenkins, May 1974).

Sample No.	G.M.T		Wind		Starting		Ending		Vessel		Approx. distance nearest land (n.ml.)†	Arthropods
	Time	Date	True Dir.	Vel. (kts)	Lat.	Long.	Lat.	Long.	Speed (kts)	Course°		
1	2000	7.V.74	ESE	15	24°42'S	176°58'E	21°20'S	177°34'E	14.5	009	Kadavu, Fiji 135	1 fly
2	2300	8.V.74	SE	09	19°07'S	177°53'E	18°14'S	178°35'E	Var.	Var.	Fiji ◀45	3 beetles 1 wasp
3	2300	8.V.74					(via Suva)	18°14'S	178°35'E		Fiji ◀45	1 earwig*
4	0530	10.V.74	NNW	09	16°06'S	177°00'W	15°28'S	174°35'W	14.0	075	Niuafo'ou, Tonga ◀45	1 centipede*
5	1500	11.V.74	Var.	03	Pago Pago		Apia		15.0	Var.	Samoa ◀45	6 wasps 5 flies 1 beetle 1 psocid? 1 insect part
6	1900	12.V.74	SE	13	13°46'S	171°46'W	14°52'S	172°41'W	14.0	Var./205	Samoa ◀45	8 flies 5 moths 1 beetle
7	2220	13.V.74 14.V.74	SE	18/24	17°01'S	173°40'W	20°53'S	175°13'W	14.0	205/Var.	Tonga ◀45 Tonga ◀45	10 flies 1 spider*
8	1800	14.V.74	ESE	20	Nuku'alofa		22°16'S	176°16'W	14.5	Var./209	Tonga ◀45	1 weevil

Tables 2-30 † n.ml. — Nautical mile. Note — 1 n.ml. = 1.852km. ◀ Less than * collected by hand

Table 3. *Union South Pacific Voyage No. 20* (J.A.F. Jenkins, May-June 1974).

Sample No.	G.M.T		Wind		Starting		Ending		Vessel		Approx. distance nearest land (n.ml.)†	Arthropods
	Time	Date	True Dir.	Vel. (kts)	Lat.	Long.	Lat.	Long.	Speed (kts)	Course°		
B	2000	22.V.74 30.V.74	E	09	26°07'S	176°38'E	22°20'S	177°23'E	14.5	008	Kadavu, Fiji 195 Tonga ◀45	1 wasp 2 moths*
D	2000	31.V.74	ExS	10	27°02'S	178°45'W	30°30'S	178°50'E	15.0	211	Kermadec Is 135	1 wasp 1 fly?

Table 4. *Union South Pacific Voyage No. 28 (J.A.F. Jenkins, October 1974).*

Sample No.	G.M.T		Wind		Starting		Ending		Vessel		Approx. distance nearest land (n.ml.)†	Arthropods
	Time	Date	True Dir.	Vel. (kts)	Lat.	Long.	Lat.	Long.	Speed (kts)	Course°		
2	2100	12.X.74	NW	15	32°19'S	175°44'E	29°06'S	176°24'E	13.5	009	North Cape, NZ 184	1 fly 1 bug?
6 7A	2100	14.X.74 16.X.74	E	13	21°50'S	177°35'E	18°28'S	178°14'E Suva	14.0	028	Fiji ◀45 Fiji ◀45	1 fly 8 beetles* 6 flies* 5 wasps*
7	0600	16.X.74	ENE	15	17°26'S	179°33'E	16°27'S	178°21'W	12.5	075	Fiji ◀45	1 beetle
10	1830	17.X.74	E	05	15°07'S	173°24'W	14°27'S	170°50'W	13.5	075	Samoa ◀45	2 flies 1 moth
11	0130	19.X.74	Var.	02	13°21'S	170°42'W	13°48'S	171°45'W (via Apia)	Var.	Var.	Samoa ◀45	30 flies 16 wasps 4 aphids 1 psocid
12	0530	19.X.74	ESE	09	13°44'S	171°47'W	14°04'S	172°17'W	13.5	Var./205	Samoa ◀45	1 fly 1 wasp bug parts insect parts
13	2200	19.X.74	SE	20	14°04'S	172°17'W	17°27'S	174°06'W	13.5	205	Samoa ◀45	2 wasps
14	0530	20.X.74	SE	24	17°27'S	174°06'W	19°06'S	174°39'W	14.0	201	Tonga ◀45	1 fly
16	2000	21.X.74	ENE	09	21°00'S	175°23'W	22°56'S	176°40'W	14.0	209	Tonga ◀45	2 beetles
17	0530	22.X.74	E	09	22°56'S	176°40'W	24°30'S	177°36'W	14.0	209	Ata, Tonga 45	1 wasp
20	2100	23.X.74	SxE	05	29°34'S	179°14'E	30°43'S	178°29'E	Var.	Var.	Kermadec Is 129	insect parts
23	0600	25.X.74	NxE	05	33°59'S	176°14'E	35°20'S	175°22'E	10.0	209	New Zealand ◀45	1 fly

Table 5. *Union South Pacific Voyage No. 31 (J.A.F. Jenkins, December 1974).*

Sample No.	G.M.T Time Date	Wind True Dir.	Wind Vel. (kts)	Starting Lat. Long.	Ending Lat. Long.	Vessel Speed (kts)	Course	Approx. distance nearest land (n.m.)†	Arthropods
1	0700 3.XII.74	SW	13	34°02'S 175°20'E	31°55'S 175°44'E	13.0	009	Cape Brett, NZ 87	20 flies
2	2000 3.XII.74	SW	15	31°55'S 175°44'E	29°05'S 176°11'E	13.0	009	North Cape, NZ 200	1 fly
3	0400 4.XII.74	SE	13	26°48'S 176°35'E	27°20'S 176°28'E	13.5	009	Kermadec Is 270	1 fly*
5	2000 4.XII.74	SE	13	26°48'S 176°35'E	23°41'S 177°07'E	13.5	009	Kadavu, Fiji 272	2 flies
6	0700 4.XII.74	S	13	23°41'S 177°07'E	22°50'S 177°13'E	13.5	010	Kadavu, Fiji 228	1 butterfly*
7	0700 5.XII.74	S	13	23°41'S 177°07'E	21°17'S 177°30'E	13.5	010	Kadavu, Fiji 128	3 flies
8	2000 5.XII.74	SE	10	21°17'S 177°30'E	18°30'S 178°13'E	14.0	035	Fiji 445	2 flies
9	2000 5.XII.74	E	15	17°25'S 179°56'E	18°30'S 178°13'E	12.0	075	Fiji 445	1 beetle*
10	0600 7.XII.74	E	15	17°25'S 179°56'E	16°25'S 178°10'W	12.0	075	Fiji 445	1 bug?
12	0600 7.XII.74	SE	09	15°37'S 175°14'W	15°29'S 174°39'W	13.0	075	Fiji 445	1 spider*
13	0600 8.XII.74	SE	09	15°37'S 175°14'W	15°04'S 173°08'W	13.0	075	Niuafo'ou, Tonga 445	2 flies
15	8.XII.74			Pago Pago				Samoa 445	1 moth*
16	9.XII.74			13°55'S 172°15'W				Samoa 445	1 moth*
17	0600 10.XII.74	Var.	02	14°02'S 172°16'W	15°43'S 173°03'W	14.0	205	Samoa 445	2 fly parts
18	1900 10.XII.74	ESE	13	15°43'S 173°03'W	18°20'S 174°22'W	13.0	205	Tonga 445	insect parts
19	Nuk			Nuku'alofa				Tonga 445	insect parts
23	14.XII.74			30°37'S 178°45'E				(cargo)	1 earwig*
25	1900 15.XII.74	NE	09	32°56'S 177°12'E	35°13'S 175°33'E	14.0	217	Poor Knights Is, NZ 45	1 lacewing

Table 6. *Union South Pacific Voyage No. 32* (J.A.F. Jenkins, December 1974-January 1975).

Sample No.	G.M.T Time	Wind True Dir.	Wind Vel. (kts)	Starting Lat.	Starting Long.	Ending Lat.	Ending Long.	Vessel	Course	Approx. distance nearest land (n.ml.)†	Arthropods
26	0700	SSW	13	35°23'S	175°04'E	32°33'S	175°35'E	New Zealand	45	2 lacewings	2 lacewings
27	0700	SSW	13	32°33'S	175°35'E	32°33'S	175°35'E	North Cape, NZ	168	1 moth	1 moth
28	1930	SSW	13	32°33'S	175°35'E	29°45'S	176°08'E	North Cape, NZ	168	1 lacewing	1 lacewing*
29	20.XII.74	SSW	13	32°33'S	175°35'E	29°45'S	176°08'E	(cargo)		1 spider*	1 spider*
30	0700	ESE	18	29°45'S	176°08'E	27°13'S	176°38'E	Kermadec Is	277	1 fly	1 fly
34	2330	SSE	09	19°13'S	177°52'E	18°25'S	178°16'E	Fiji	45	2 flies	2 wasps
35	1930	SE	09	17°52'S	179°00'E	16°25'S	178°10'W	Fiji	45	1 fly	2 aphids
36	0600	Var.	02	16°25'S	178°10'W	15°49'S	175°55'W	Niuafo'ou, Tonga	45	1 bug	1 ant
37	1900	Var.	05	15°49'S	175°55'W	15°01'S	173°02'W	Niuafo'ou, Tonga	45	1 aphid	1 aphid
38	0600	Var.	05	15°01'S	173°02'W	14°27'S	170°49'W	Samoa	45	2 flies	2 flies
39	0500	NE	13	15°21'S	172°58'W	17°14'S	173°50'W	Tonga	45	1 fly	1 fly
40	28.XII.74			20°13'S	175°07'W			Tonga	45	1 moth*	1 moth*
42	30.XII.74							Tonga	45	1 wasp	1 wasp
43	30.XII.74							Tonga	45	1 moth	1 moth
44	31.XII.74	Var.	02	21°10'S	175°30'W	23°33'S	177°03'W	Tonga	45	1 fly	1 fly

Table 7. *Union South Pacific* Voyage No. 35 (J.A.F. Jenkins, February-March 1975).

Sample No.	G.M.T Time Date	Wind True Vel. Dir. (kts)	Starting Lat. Long.	Ending Lat. Long.	Vessel Speed (kts)	Vessel Course°	Approx. distance nearest land (n.m.).†	Arthropods
5	0615 26.II.75	SE 09	21°14'S 177°41'E	18°52'S 178°02'E	14.0	009/027	Fiji ▶45	2 wasps 1 aphid 1 fly?
6	2000 27.II.75	NW 13	17°36'S 179°14'E	16°14'S 178°06'W	13.5	067	Fiji ▶45	1 fly
7	0600 28.II.75	NNE 09	16°14'S 178°06'W	15°28'S 175°54'W	13.5	067	Ninifo'u, Tonga ▶45	1 fly part
8	2300 28.II.75	NE 05	15°28'S 175°54'W	13°51'S 172°15'W	13.5	067	Samoa ▶45	1 aphid part
8A	0700 4.III.75	NE 05	15°17'S 171°27'W	17°30'S 173°13'W	14.0	219	Tonga 70	2 bugs 1 fly

Table 8. *Union South Pacific* Voyage No. 36 (J.A.F. Jenkins, March 1975).

Sample No.	G.M.T Time Date	Wind True Vel. Dir. (kts)	Starting Lat. Long.	Ending Lat. Long.	Vessel Speed (kts)	Vessel Course°	Approx. distance nearest land (n.m.).†	Arthropods
18	2000 15.III.75	NE 05	23°31'S 177°15'E	20°25'S 177°44'E	14.0	007	Kadavu, Fiji 78	1 aphid 2 flies 1 beetle
19	0630 16.III.75	NE 09	20°25'S 177°44'E	18°10'S 178°24'E	14.0	Var.	Fiji ▶45	2 bugs 1 bug part
20	2000 17.III.75	E 13	18°14'S 178°36'E	16°25'S 178°15'W	13.5	Var./075	Fiji ▶45	1 bug part

Table 9. *Union South Pacific Voyage No. 39 (J.A.F. Jenkins, May 1975).*

Sample No.	G.M.T		Wind		Starting		Ending		Vessel Speed (kts)	Vessel Course°	Approx. distance nearest land (n.ml.)†	Arthropods
	Time	Date	True Dir.	Vel. (kts)	Lat.	Long.	Lat.	Long.				
1	0600	2.V.75	ENE	13	34°47'S	175°14'E	33°40'S	175°30'E	13.5	009	Cape Brett, NZ 53	1 fly 1 fly larva 1 crustacean
5	2130	4.V.75	Var.	02	22°07'S	177°29'E	18°32'S	178°13'E	14.0	006/029	Fiji ◀45	1 wasp
6		6.V.75					Suva				Fiji ◀45	1 cockroach*
9	2300	9.V.75	NNE	09	14°04'S	172°18'W	15°12'S	172°50'W	15.0	205	Samoa ◀45	1 fly 1 bug nymph
10	0500	10.V.75	Var.	05	15°12'S	172°50'W	16°30'S	173°29'W	15.0	205	Tonga ◀45	1 fly 1 spider part
11	1900	10.V.75	Var.	02	16°30'S	173°29'W	19°32'S	174°50'W	15.0	201	Tonga ◀45	1 fly
12	0030	11.V.75	Var.	05	19°32'S	174°50'W	20°50'S	175°12'W	15.0	201/174	Tonga ◀45	1 wasp
13	0400	11.V.75	Var.	05	20°50'S	175°12'W	Nuku'alofa		15/00	174/Var.	Tonga ◀45	4 wasps 1 beetle 1 bug
15A	2100	12.V.75	Var.	02	23°22'S	176°57'W	26°45'S	179°02'W	14.0	209	Ata, Tonga 75	1 ant*
17	2000	13.V.75	SSW	05	28°30'S	179°49'E	31°26'S	178°03'E	14.0	209	Kermadec Is 107	1 aphid

Table 10. *Union South Pacific Voyage No. 40 (J.A.F. Jenkins, May 1975).*

Sample No.	G.M.T		Wind		Starting		Ending		Vessel Speed (kts)	Vessel Course°	Approx. distance nearest land (n.ml.)†	Arthropods
	Time	Date	True Dir.	Vel. (kts)	Lat.	Long.	Lat.	Long.				
19	0000	17.V.75	NW	09	33°55'S	175°20'E	32°28'S	175°36'E	14.00	009	Cape Brett, NZ 94	1 aphid
21	1900	17.V.75	NE	09	31°18'S	175°51'E	28°05'S	176°24'E	14.00	009	North Cape, NZ 233	1 fly
23	2000	18.V.75	E	15/30	25°46'S	176°59'E	22°30'S	177°27'E	13.5	007	Kadavu 202	1 fly
		23.V.75			Apia						Samoa ◀45	1 wasp*
25	0500	24.V.75	ESE	15	14°04'S	172°20'W	15°00'S	172°43'W	14.0	205	Samoa ◀45	2 flies 1 wasp 1 bug 1 insect part
28	2000	25.V.75	ExS	15	20°19'S	175°10'W	Nuku'alofa		14.0/00	Var.	Tonga ◀45	3 flies 2 wasps
29	0500	27.V.75	NW	09	23°36'S	177°08'W	25°20'S	178°10'W	14.0	209	Ata, Tonga 82	2 flies 1 wasp
31	0100	28.V.75	Var.	02	28°17'S	179°58'W	29°15'S	179°25'E	14.0	209	Kermadec Is 78	1 fly 1 moth

Table 11. *Marama* Voyage No. 1 (J.A.F. Jenkins, January 1978).

Sample No.	G.M.T		Wind		Starting		Ending		Vessel		Approx. distance nearest land (n.ml.)†	Arthropods
	Time	Date	True Dir.	Vel. (kts)	Lat.	Long.	Lat.	Long.	Speed (kts)	Course°		
1	0500	11.I.78	SW/ Var.	09/02	33°13'S	175°25'E	31°02'S	175°48'E	16.5	008	Cape Brett, NZ 130	5 lacewings 2 flies 1 aphid
2	1930	11.I.78	Var./S	02/05	31°02'S	175°48'E	27°03'S	176°27'E	17.0	008	North Cape, NZ 250	1 weevil
3	0100	12.I.78	S	05	27°03'S	176°27'E	25°20'S	176°47'E	17.0	008	Kermadec Is 330 Hunter I 314	1 fly
4	0700	12.I.78	S	05	25°20'S	176°47'E	23°37'S	177°03'E	17.0	008	Kadavu, Fiji 277 Hunter I 289	1 spider
6	0130	13.I.78	S	05	20°20'S	177°39'E	18°23'S	177°17'E	17.0	346	Fiji ◀45	1 wasp 1 bug
7	1830	15.I.78	ESE	15	17°38'S	178°05'W	17°16'S	177°20'W	16.0	066	Fiji ◀45	1 psocid
8	0100	16.I.78	ESE	15	17°16'S	177°20'W	16°27'S	175°23'W	16.0	066	Niuafu'ou, Tonga 50 Apia	1 fly
10	1830	18.I.78	E	09	14°25'S	172°25'W	16°49'S	173°30'W	18.0	205	Samoa ◀45	2 bugs*
12	0830	19.I.78	E	13	19°12'S	174°36'W	20°49'S	175°14'W	17.5	168	Samoa ◀45	2 flies
13	0200	20.I.78	SE	18			Nuku'alofa				Tonga ◀45	1 aphid
											Tonga ◀45	▶25 flies 16 wasps 2 ants 1 bug
18	0500	20.I.78 23.I.78	E	13	32°59'S	177°22'E	Nuku'alofa 35°28'S	175°44'E	17.0	208	Tonga ◀45 New Zealand ◀45	3 wasps* 1 bug part

▶ More than.

Table 12. *Martama* Voyage No. 4 (J.A.F. Jenkins, March 1978).

Sample No.	G.M.T	Wind	True Vel.	Dir. (kts)	Starting Lat.	Starting Long.	Ending Lat.	Ending Long.	Vessel	Speed (kts)	Course°	Approx. distance nearest land (n.m.l.)†	Arthropods
1	0300	E/ly	05	E	16°08'S	174°32'W	15°28'S	173°00'W	Tonga ◀45	15.0	064	Tonga ◀45	fly parts
3	2000	E	05	E	14°15'S	172°24'W	17°39'S	173°38'W	Samoa ◀45	17.0	219	Samoa ◀45	1 ant 1 fly
3	2000						17°39'S	173°38'W	Tonga ◀45		207	Tonga ◀45	1 bug* 3 flies
4	0100	E	02	E	17°39'S	173°38'W	18°50'S	174°19'W	Tonga ◀45	17.5	207	Tonga ◀45	3 flies

Table 13. *Martama* Voyage No. 5 (J.A.F. Jenkins, March 1978).

Sample No.	G.M.T	Wind	True Vel.	Dir. (kts)	Starting Lat.	Starting Long.	Ending Lat.	Ending Long.	Vessel	Speed (kts)	Course°	Approx. distance nearest land (n.m.l.)†	Arthropods
10	0930	SSE	09	SSE	35°28'S	175°03'E	33°53'S	175°17'E	New Zealand ◀45	17.5	008	New Zealand ◀45	2 flies 1 moth

Table 14. *Martama* Voyage No. 6 (J.A.F. Jenkins, March-April 1978).

Sample No.	G.M.T	Wind	True Vel.	Dir. (kts)	Starting Lat.	Starting Long.	Ending Lat.	Ending Long.	Vessel	Speed (kts)	Course°	Approx. distance nearest land (n.m.l.)†	Arthropods
15	0400	SW	09	SW	32°41'S	175°26'E	31°36'S	175°36'E	North Cape, NZ 158	16.0	008	North Cape, NZ 158	1 fly
16	0900	SW	13	SW	31°36'S	175°36'E	30°18'S	175°48'E	North Cape, NZ 215	16.0	009	North Cape, NZ 215	1 fly
17	2100	ESE	13	ESE	30°18'S	175°48'E	27°07'S	176°26'E	North Cape, NZ 286	15.7	009	North Cape, NZ 286	insect parts
18	0000	ESE	15	ESE	27°07'S	176°26'E	26°24'S	176°31'E	Kermadec Is 324	15.7	009	Kermadec Is 324	1 insect part
18	0400	ESE	18	ESE	21°20'S	177°28'E	19°14'S	177°33'E	Fiji ◀45	16.0	008/344	Fiji ◀45	1 beetle*
23	0900	SXE	15	SXE	18°12'S	178°26'E	18°12'S	179°49'W	Fiji ◀45	15.5	094/083	Fiji ◀45	1 wasp
24	2100	SXE	15/09	SXE	18°12'S	179°49'W	17°14'S	177°10'W	Fiji ◀45	Var.	083/067	Fiji ◀45	2 beetles
25	0230	SXE	05	SXE	17°14'S	177°10'W	16°40'S	175°58'W	Ninatonu, Tonga 68	15.0	068	Ninatonu, Tonga 68	1 fly
25	30.III.78								Samoa ◀45			Samoa ◀45	1 beetle*
29	0330	Var.	02	Var.	16°58'S	173°28'W	18°05'S	173°57'W	Tonga ◀45	15.0	204	Tonga ◀45	1 fly 1 cockroach*
31	2200	S'ly	09	S'ly	22°22'S	176°20'W	25°10'S	177°57'W	Tonga ◀45	15.0	208	Tonga ◀45	1 beetle

Table 15. *Marama* Voyage No. 10 (J.A.F. Jenkins, June 1978).

Sample No.	G.M.T		Wind		Starting		Ending		Vessel		Approx. distance nearest land (n.ml.)†	Arthropods
	Time	Date	True Dir.	Vel. (kts)	Lat.	Long.	Lat.	Long.	Speed (kts)	Course°		
6	2100	2.VI.78	SE	15	20°58'S	177°23'E	18°14'S	177°12'E	17.0	012/042	Fiji ◀45	insect parts 2 flies insect parts 6 flies insect parts
10	0100	10.VI.78	SE	05	13°53'S	172°12'W	15°05'S	172°54'W	16.0	208	Samoa ◀45	
11	1000	10.VI.78	SE	05	15°05'S	172°54'W	17°08'S	173°57'W	15.0	204	Tonga ◀45	

Table 16. *Marama* Voyage No. 11 (J.A.F. Jenkins, June 1978).

Sample No.	G.M.T		Wind		Starting		Ending		Vessel		Approx. distance nearest land (n.ml.)†	Arthropods
	Time	Date	True Dir.	Vel. (kts)	Lat.	Long.	Lat.	Long.	Speed (kts)	Course°		
18	0900	19.VI.78	E	15	19°39'S	176°53'E	18°18'S	177°02'E	16.0	013	Fiji ◀45	1 aphid insect parts 1 fly 1 ant 5 flies
19	0351	21.VI.78	NE	15	18°13'S	178°29'E	18°13'S	179°52'W	16.5	083	Fiji ◀45	
21	0300	24.VI.78	NE	09	13°50'S	172°11'W	14°32'S	172°31'W	16.0	205	Samoa ◀45	
22	0830	24.VI.78	ENE	09	14°32'S	172°31'W	15°58'S	173°09'W	16.0	207	Tonga ◀45	insect parts insect parts insect parts insect parts
23	2000	24.VI.78	Var.	02	15°58'S	173°09'W	18°42'S	174°30'W	16.0	201	Tonga ◀45	
24	2300	24.VI.78	E	05	18°42'S	174°30'W	19°29'S	174°49'W	16.0	201	Tonga ◀45	
25	0300	25.VI.78	WNW	15	19°29'S	174°49'W	20°32'S	175°15'W	16.0	201	Tonga ◀45	

Table 17. *Marama* Voyage No. 12 (J.A.F. Jenkins, June-July 1978).

Sample No.	G.M.T		Wind		Starting		Ending		Vessel		Approx. distance nearest land (n.ml.)†	Arthropods
	Time	Date	True Dir.	Vel. (kts)	Lat.	Long.	Lat.	Long.	Speed (kts)	Course°		
38	0515	7.VII.78	SE	05	14°24'S	170°44'W	13°51'S	171°26'W	17.0	311	Samoa ◀45	1 beetle 3 flies 1 fly insect parts
39	2100	7.VII.78	Var.	05	13°51'S	171°26'W	Apia		17/00	Var.	Samoa ◀45	
40	0300	8.VII.78	NE	05	13°43'S	171°58'W	14°36'S	172°34'W	16.5	205	Samoa ◀45	

Table 18. *Marama* Voyage No. 13 (J.A.F. Jenkins, July 1978).

Sample No.	G.M.T		Wind		Starting		Ending		Vessel		Approx. distance nearest land (n.ml.)†	Arthropods
	Time	Date	True Dir.	Vel. (kts)	Lat.	Long.	Lat.	Long.	Speed (kts)	Course°		
44	0500	15.VII.78	SW	18	33°05'S	175°27'E	32°23'S	175°47'E	17.0	009	Cape Brett, NZ 135	1 psocid
48	2100	19.VII.78	NNE	13	18°17'S	179°42'E	17°55'S	178°56'W	16.0	053	Fiji ◀45	bug parts

Table 19. *Marama* Voyage No. 15 (for J.A.F. Jenkins, August 1978).

Sample No.	G.M.T		Wind		Starting		Ending		Vessel		Approx. distance nearest land (n.ml.)†	Arthropods
	Time	Date	True Dir.	Vel. (kts)	Lat.	Long.	Lat.	Long.	Speed (kts)	Course°		
		22.VIII.78	SE	18	15°50'S	173°40'W			16.5	064	Tonga ◀45	1 wasp*

Table 20. *Marama* Voyage No. 17 (for J.A.F. Jenkins, September 1978).

Sample No.	G.M.T		Wind		Starting		Ending		Vessel		Approx. distance nearest land (n.ml.)†	Arthropods
	Time	Date	True Dir.	Vel. (kts)	Lat.	Long.	Lat.	Long.	Speed (kts)	Course°		
		25.IX.78	SSE	13	18°02'S	174°12'W			17.0	206	Tonga ◀45	1 bug*

Table 21. *Marama* Voyage No. 24 (J.A.F. Jenkins, December 1978-January 1979).

Sample No.	G.M.T		Wind		Starting		Ending		Vessel		Approx. distance nearest land (n.ml.)†	Arthropods
	Time	Date	True Dir.	Vel. (kts)	Lat.	Long.	Lat.	Long.	Speed (kts)	Course°		
1	0300	30.XII.78	SSE	18	33°04'S	175°29'E	30°59'S	175°47'E	17.0	008	Cape Brett, NZ 138	1 insect part
3	2100	30.XII.78	S	30	29°15'S	176°00'E	25°56'S	176°23'E	17.0	008	Kermadec Is 295 Hunter I 319	insect parts
5	0900	31.XII.78	SSW	15	24°48'S	176°50'E	22°27'S	177°09'E	17.0	009	Kadavu, Fiji 202	insect parts
6	2100	31.XII.78	WSW	05	22°27'S	177°09'E	19°06'S	177°10'E	17.0	000	Fiji ◀45	1 bug part
8	0300	4.I.79	Var.	05	15°50'S	176°53'W	15°01'S	175°02'W	17.0	067	Niuafu'ou, Tonga ◀45	1 fly 1 psocid
10	0300	6.I.79	Var.	05	14°30'S	170°50'W	15°55'S	171°45'W	17.0	218	Samoa ◀45	1 wasp 1 fly
12	2100	6.I.79	Var.SW	05/ 13-24	17°13'S	172°58'W	19°44'S	174°49'W	17.0	214/207	Tonga ◀45	1 psocid
15	0000	10.I.79	NE	02	32°22'S	177°31'E	33°48'S	176°37'E	17.0	208	Cape Brett, NZ 142	1 wasp
17	0800	10.I.79	NW	05	34°43'S	176°00'E	35°40'S	175°10'E	17.0	208	New Zealand ◀45	2 wasps

Table 22. *Maramba* Voyage No. 25 (J.A.F. Jenkins, January 1979).

Sample No.	G.M.T Time	Date	Wind True Dir.	Wind Vel. (kts)	Starting Lat.	Starting Long.	Ending Lat.	Ending Long.	Vessel Speed (kts)	Course	Approx. distance nearest land (n.m.):†	Arthropods
18	1930	12.1.79	Var	02	35°05'S	175°07'E	31°40'S	175°42'E	17.0	008	New Zealand ▶45	1 psocid 1 wasp 3 wasps
19	0000	13.1.79	E/ly	05	31°40'S	175°42'E	30°21'S	175°54'E	17.0	008	North Cape, NZ 208	1 ant 1 aphid 1 bug part 1 spider Fly parts insect parts
24	0100	17.1.79	NW	09	18°13'S	178°28'E	17°18'S	179°46'E	17.0	060	Fiji ▶45	1 ant 1 aphid 1 wasp part 1 wasp 1 spider Fly parts insect parts
25	0900	17.1.79	N	24/09	17°18'S	179°46'E	16°17'S	178°06'W	17.0	060/067	Fiji ▶45	1 insect part insect parts 1 wasp part 1 aphid 1 beetle part 1 spider Fly parts insect parts
26	2000	17.1.79	Var.	09	16°17'S	178°06'W	15°09'S	175°05'W	17.0	067	Niuafo'ou, Tonga ▶45	1 fly beetle parts ant parts insect part
27	0230	18.1.79	Var.	05	15°09'S	175°05'W	14°12'S	173°11'W	17.0	065	Niuafo'ou, Tonga ▶45	1 beetle part 1 insect part 1 beetle 1 weevil part 1 aphid 1 wasp part 6 flies 2 beetles? 1 moth 1 moth part?
28	0530	18.1.79	Var.	05	14°12'S	173°11'W	13°59'S	172°32'W	17.0	065	Samoa ▶45	insect parts 1 moth 1 moth part? insect parts
29	0930	18.1.79	Var.	05	13°59'S	172°32'W	Apia		17/00	Var.	Samoa ▶45	1 fly 1 fly? 1 fly 5 wasps 2 aphids 1 butterfly 2 wasps
30	0300	20.1.79	S	13	14°33'S	170°52'W	15°49'S	171°52'W	17.0	218	Samoa ▶45	1 fly insect parts
31	0800	20.1.79	SE	13	15°49'S	171°52'W	16°58'S	172°39'W	17.0	218	Tafahi, Tonga 88	1 fly
34	1900	23.1.79	Var.	05	28°45'S	179°49'E	32°20'S	177°36'E	17.0	208	Kermadec Is 124	1 fly
35	0200	24.1.79	Var.	05	32°20'S	177°36'E	34°05'S	176°33'E	17.0	209	Cape Brett, NZ 131	2 aphids 5 wasps
36	0730	24.1.79	SE	09	34°05'S	176°33'E	35°30'S	175°40'E	17.0	209	New Zealand ▶45	1 butterfly 2 wasps

Table 23. *Marama* Voyage No. 30 (J.A.F. Jenkins, April 1979).

Sample No.	G.M.T		Wind		Starting		Ending		Vessel		Approx. distance nearest land (n.ml.)†	Arthropods
	Time	Date	True Dir.	Vel. (kts)	Lat.	Long.	Lat.	Long.	Speed (kts)	Course°		
1	0345	7.IV.79	ENE	13	33°04'S	175°19'E	31°24'S	175°27'E	17.0	006	North Cape, NZ 140	1 fly
2	0930	7.IV.79	ExS	13	31°24'S	175°27'E	29°46'S	175°38'E	17.0	006	North Cape, NZ 223	3 flies 1 wasp
3	1945	7.IV.79	E	09	29°46'S	175°38'E	26°49'S	175°59'E	17.0	007	Kermadec Is 305	1 fly
4	0310	8.IV.79	SE	15	26°49'S	175°59'E	24°45'S	176°15'E	17.0	007	Hunter I 275	1 fly
5	1010	8.IV.79	SE	15	24°45'S	176°15'E	22°50'S	176°35'E	17.0	007	Kadavu, Fiji 236 Hunter I 255	1 fly part
6	2100	8.IV.79	SSE	15	22°50'S	176°35'E	19°51'S	176°55'E	17.0	006	Kadavu, Fiji 77	1 fly
7	0350	9.IV.79	SSE	18	19°51'S	176°55'E	18°02'S	177°08'E	17.0	010	Fiji ◀45	fly parts
8	0500	14.IV.79	SExE	09	14°27'S	170°47'W	15°34'S	171°42'W	17.0	218	Samoa ◀45	1 fly
9	0900	14.IV.79	SSE	13	15°34'S	171°42'W	16°27'S	172°24'W	17.0	218	Niuaotoputapu, Tonga 85	insect parts
10	2000	14.IV.79	ESE	05	16°27'S	172°24'W	18°55'S	174°20'W	17.0	218/209	Tonga ◀45	1 wasp

Table 24. *Marama* Voyage No. 31 (J.A.F. Jenkins, April-May 1979).

Sample No.	G.M.T		Wind		Starting		Ending		Vessel		Approx. distance nearest land (n.ml.)†	Arthropods
	Time	Date	True Dir.	Vel. (kts)	Lat.	Long.	Lat.	Long.	Speed (kts)	Course°		
13	0900	21.IV.79	ESE	09	32°18'S	175°22'E	30°49'S	175°32'E	16.5	006	North Cape, NZ 170	insect parts
14	2100	21.IV.79	ESE	09	30°49'S	175°32'E	27°28'S	175°59'E	16.5	006	North Cape, NZ 258	1 wasp part
15	0100	22.IV.79	SE	09	27°28'S	175°59'E	26°24'S	176°05'E	16.5	006	Kermadec Is 337	1 wasp part
20	0945	25.IV.79	SE	15/24	17°43'S	179°06'E	16°54'S	179°30'W	16.5	046/062	Fiji ◀45	1 aphid
23	1530	26.IV.79	Var.	05	14°27'S	173°53'W	13°46'S	171°45'W	16.5	067/Var.	Samoa ◀45	1 moth
24	0200	1.V.79	S	24/18	26°20'S	178°45'W	27°45'S	179°31'W	16.5	208	Kermadec Is 120	1 fly

Table 25. *Marama* Voyage No. 32 (J.A.F. Jenkins, May 1979).

Sample No.	G.M.T		Wind		Starting		Ending		Vessel		Approx. distance nearest land (n.ml.)†	Arthropods
	Time	Date	True Dir.	Vel. (kts)	Lat.	Long.	Lat.	Long.	Speed (kts)	Course°		
26	0400	10.V.79	SSE	05	18°06'S	178°48'E	17°04'S	179°49'W	17.0	040/060	Fiji ◀45	1 fly 1 beetle 1 aphid
27	0900	10.V.79	SSE	09	17°04'S	179°49'W	16°27'S	178°33'W	16.5	060/067	Fiji ◀45	2 flies

Table 26. *Marama* Voyage No. 37 (J.A.F. Jenkins, July-August 1979).

Sample No.	G.M.T	Wind	True Vel.	Starting	Ending	Vessel	Approx. distance	Arthropods
	Time Date	Dir.	(kts)	Lat. Long.	Lat. Long.	Course°	nearest land (n.m.l.)†	
1	0020	21.VII.79	SE	32°05'S 175°25'E	31°13'S 175°29'E	006	North Cape, NZ 178	1 thrips
3	0945	21.VII.79	ExS	29°25'S 175°44'E	28°32'S 175°48'E	007	Kermadec Is 312	1 psocid nymph
5	0500	30.VII.79	ENE	21°28'S 175°43'W	22°43'S 176°30'W	210	Tonga ▶45	1 insect part
8	0100	31.VII.79	NExN	26°28'S 178°46'W	27°45'S 179°30'W	208	Kermadec Is 121	insect parts

Table 27. *Marama* Voyage No. 38 (J.A.F. Jenkins, August 1979).

Sample No.	G.M.T	Wind	True Vel.	Starting	Ending	Vessel	Approx. distance	Arthropods
	Time Date	Dir.	(kts)	Lat. Long.	Lat. Long.	Course°	nearest land (n.m.l.)†	
12	0030	4.VIII.79	SW	33°17'S 175°18'E	32°17'S 175°25'E	006	Cape Brett, NZ 123	1 fly
13	0430	4.VIII.79	SSW	32°17'S 175°25'E	31°10'S 175°32'E	006	North Cape, NZ 174	2 flies
14	0900	4.VIII.79	SW	31°10'S 175°32'E	29°55'S 175°42'E	006	North Cape, NZ 235	1 fly
16	0015	12.VIII.79	SxE	26°56'S 176°03'E	25°46'S 176°10'E	006	Kermadec Is 352	2 psocid nymphs
								1 fly
								1 psocid nymph
								1 fly*
25	2000	13.VIII.79	NW	23°42'S 177°06'W	26°17'S 178°39'W	208	Ata, Tonga 95	1 fly
26	0100	14.VIII.79	NW	26°17'S 178°39'W	27°36'S 179°24'W	208	Kermadec Is 122	1 psocid nymph

Table 28. *Marama* Voyage No. 42 (J.A.F. Jenkins, September-October 1979).

Sample No.	G.M.T		Wind		Starting		Ending		Vessel		Approx. distance nearest land (n.ml.)†	Arthropods
	Time	Date	True Dir.	Vel. (kts)	Lat.	Long.	Lat.	Long.	Speed (kts)	Course°		
1	0100	29.IX.79	SE	09	33°05'S	175°19'E	31°56'S	175°25'E	16.8	006	North Cape, NZ 142	3 flies 1 psocid
4	2100	29.IX.79	SxE	18	29°10'S	175°46'E	26°25'S	176°05'E	16.5	006	Kermadec Is 300	1 fly
5	0100	30.IX.79	SExE	20	26°25'S	176°05'E	25°10'S	176°13'E	16.5	006	Hunter I 273	1 fly
7	1945	30.IX.79	ESE	05	24°23'S	176°17'E	20°18'S	176°41'E	17.0	007	Kadavu, Fiji 105	2 flies 1 fly part 1 insect part
10	0430	3.X.79	ExN	09	18°12'S	178°24'E	17°15'S	179°50'E	16.0	040/060	Fiji ◀45	1 wasp 1 aphid 1 fly?
12	1900	3.X.79	E	05	16°34'S	178°49'W	15°35'S	176°31'W	16.5	067	Fiji ◀45	1 wasp
18	1900	6.X.79	ExN	05	16°31'S	172°27'W	18°37'S	174°12'W	16.5	218	Tonga ◀45	1 wasp
19	2330	6.X.79	ExN	09	18°37'S	174°12'W	19°43'S	174°36'W	16.5	207	Tonga ◀45	insect parts
20	0400	7.X.79	ExN	09	19°43'S	174°36'W	20°50'S	175°12'W	16.5	207/180	Tonga ◀45	1 wasp insect parts
21	2000	8.X.79	NE	05	23°20'S	176°56'W	25°57'S	178°26'W	16.5	208	Ata, Tonga 65	1 fly
22	0100	9.X.79	NNE	09	25°57'S	178°26'W	27°16'S	179°12'W	16.5	208	Kermadec Is 135	1 fly

Table 29. *Marama* Voyage No. 43 (J.A.F. Jenkins, October 1979).

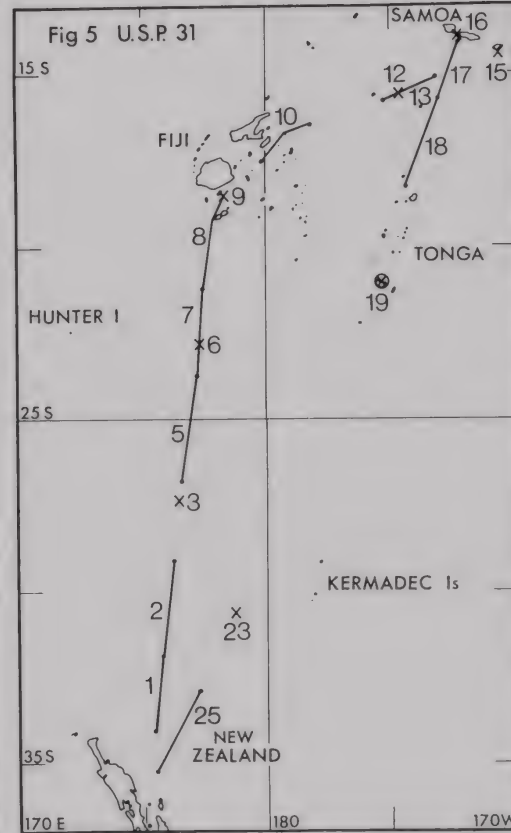
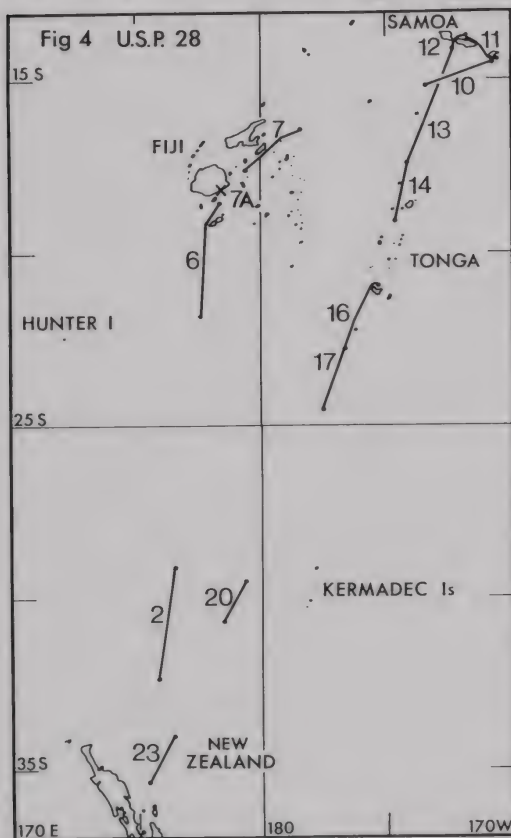
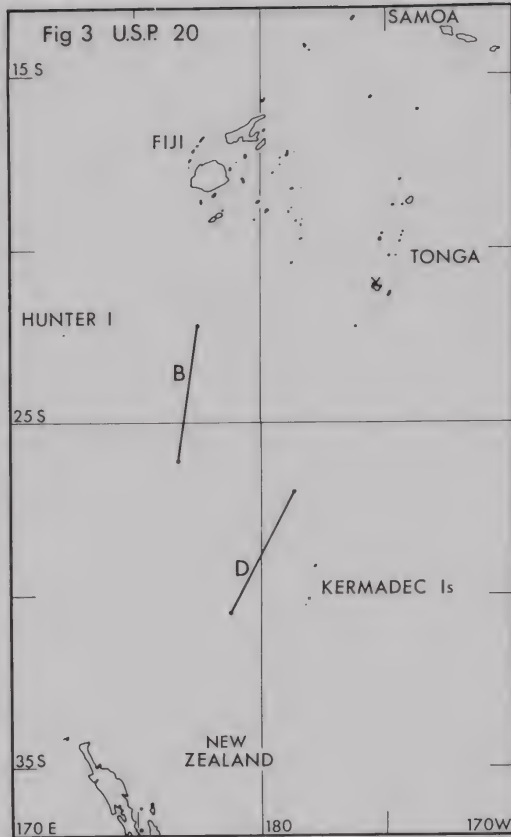
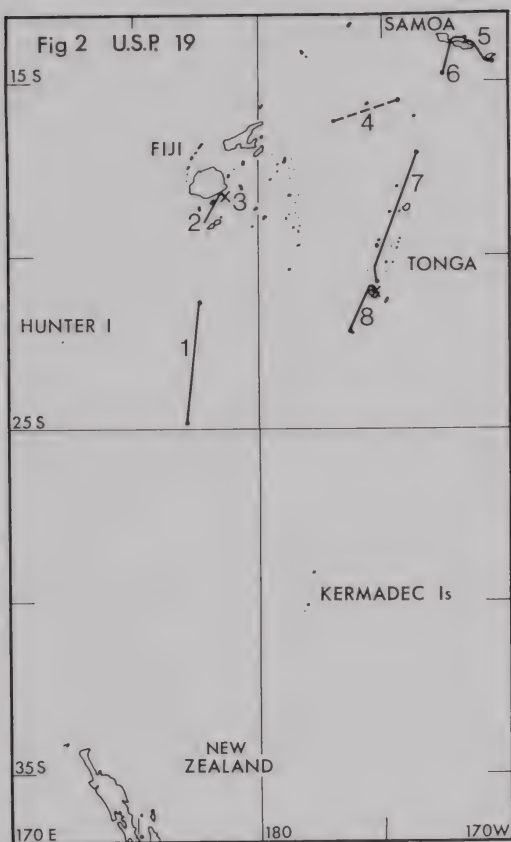
Sample No.	G.M.T		Wind		Starting		Ending		Vessel		Approx. distance nearest land (n.ml.)†	Arthropods
	Time	Date	True Dir.	Vel. (kts)	Lat.	Long.	Lat.	Long.	Speed (kts)	Course°		
25	1000	21.X.79	SW	09	24°25'S	176°25'E	23°21'S	176°30'E	16.0	007	Hunter I 255 Kadavu, Fiji 260	1 fly insect parts

Table 30. *Maranna* Voyage No. 46 (J.A.F. Jenkins, December 1979).

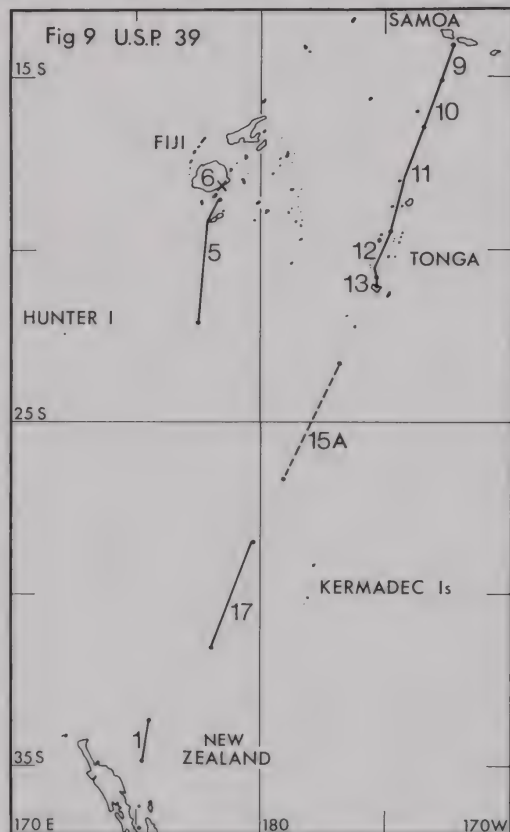
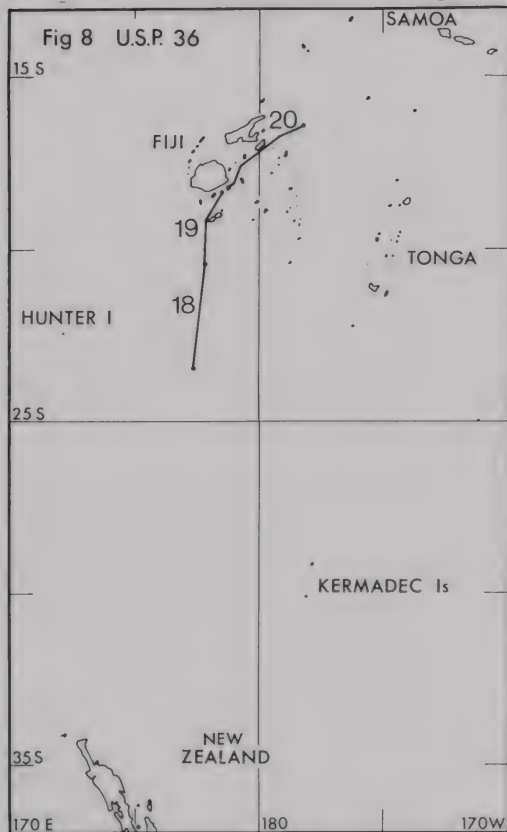
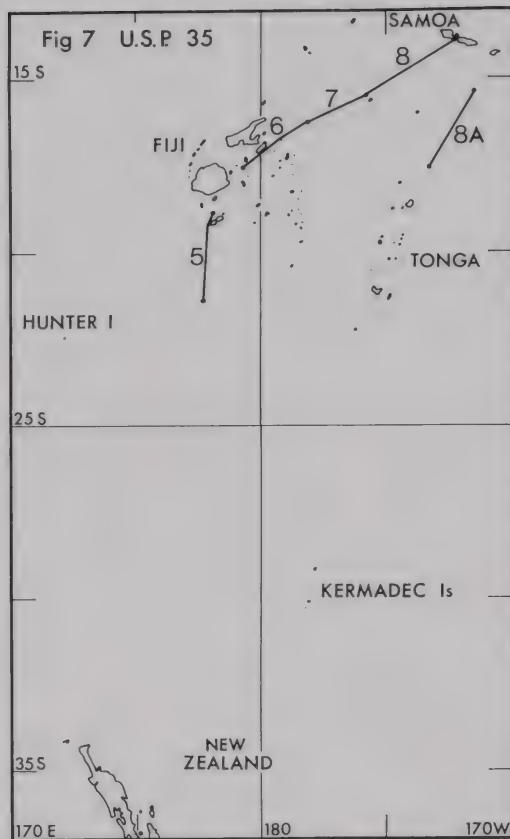
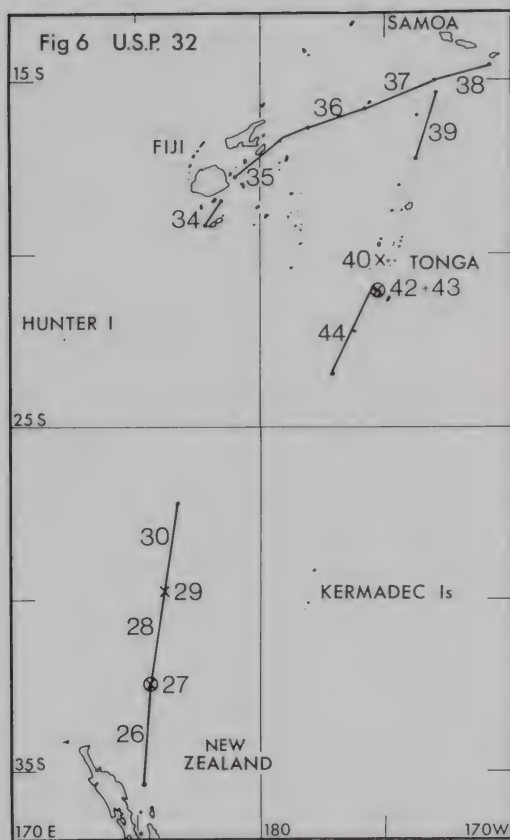
Sample No.	G.M.T Time Date	Wind True Vel. (kts)	Starting Lat. Long.	Ending Lat. Long.	Vessel Speed (kts)	Course°	Approx. distance nearest land (n.m.l.)†	Arthropods
9	0330 19.XII.79	ESE	16°09'S 177°49'W	15°34'S 176°26'W	16.0	067	Ninato'uou, Tonga ◀45	1 beetle larva? 1 bee* 1 wasp
14	0500 24.XII.79	SEXE	21°08'S 175°28'W	22°36'S 176°27'W	17.0	208	Samoa ▶45 Tonga ▶45	1 wasp 1 insect part 1 bug part
16	0000 25.XII.79	ESE	26°10'S 178°34'W	27°15'S 179°13'W	16.5	208	Kermadec Is 135	1 wasp 1 wasp part 1 insect part

Key to Figures 2-25

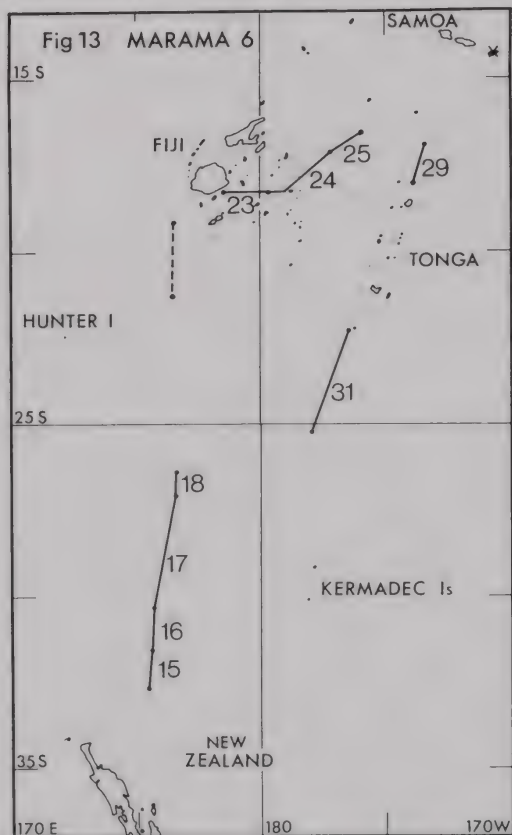
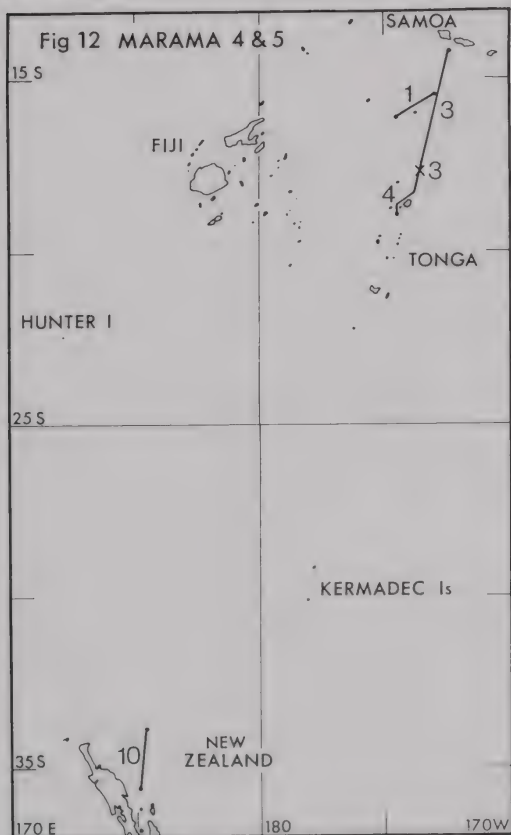
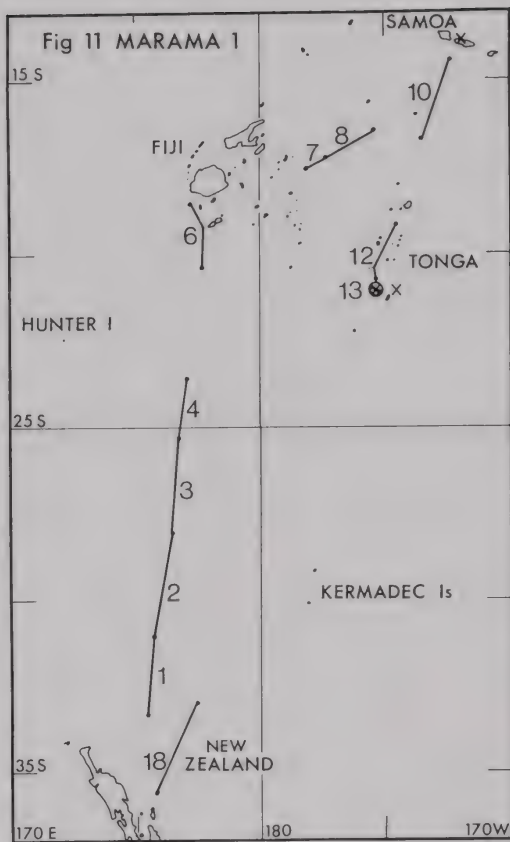
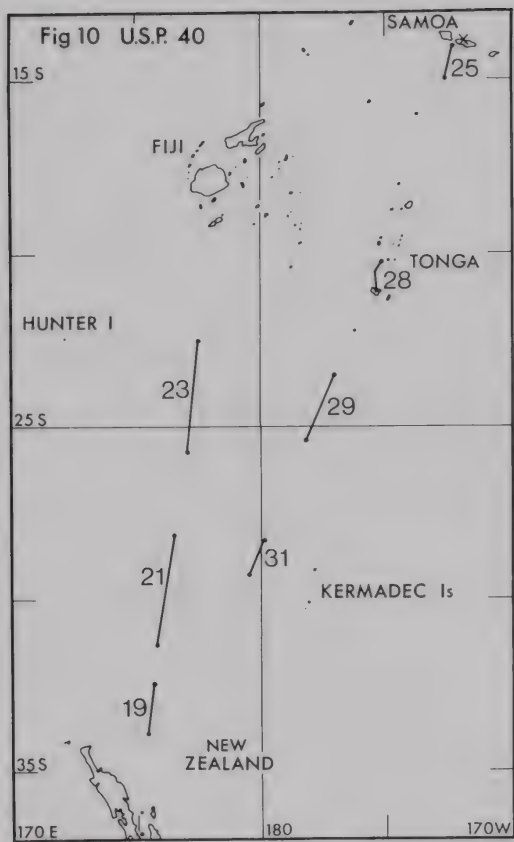
- Solid line indicates successful net run — specimen(s) trapped.
 ---- Dashed line indicates specimen(s) hand collected during run.
 × Cross indicates a position for hand collected specimen(s).
 ⊗ Cross in circle indicates a position for trapped specimen(s).



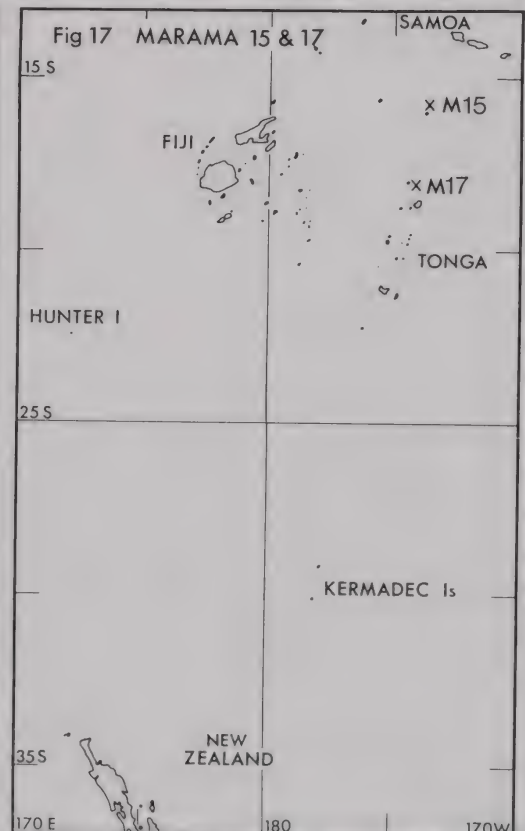
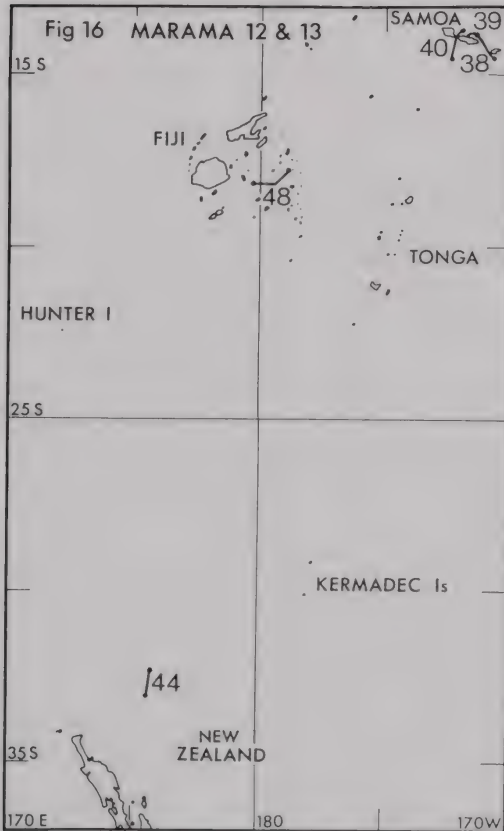
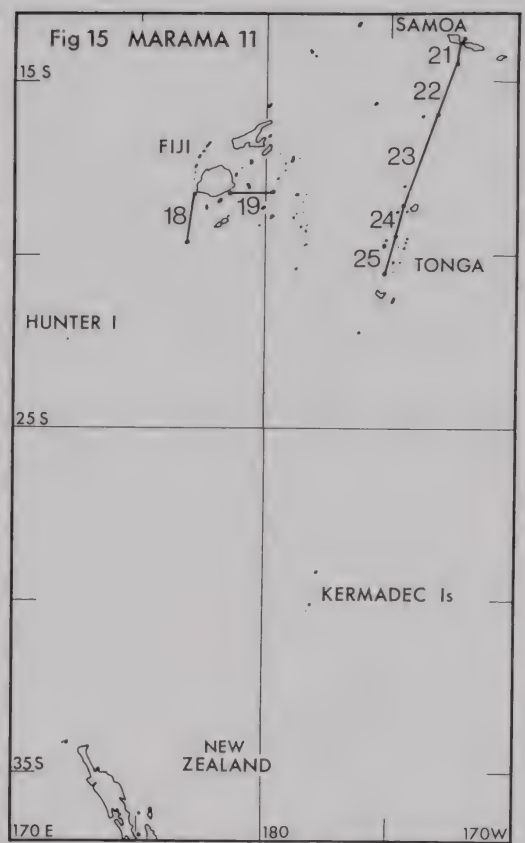
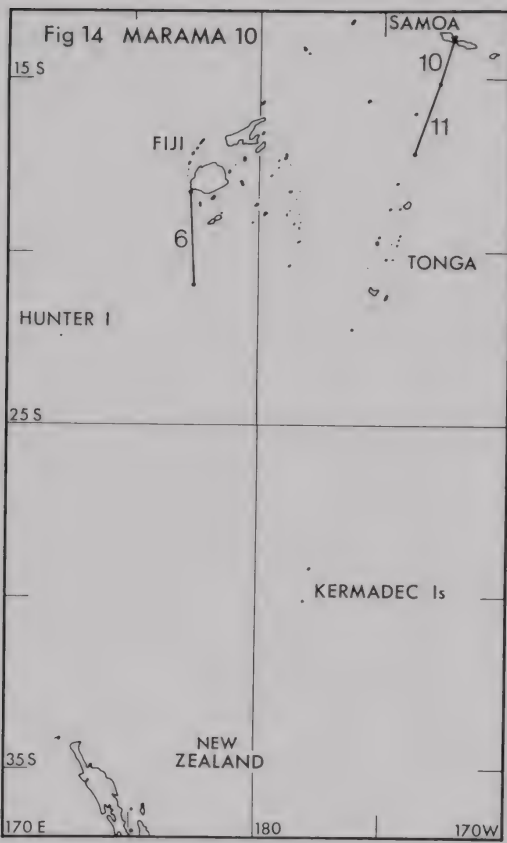
Figs. 2-5. Successful net runs and collections on *Union South Pacific* voyages. 2. Voyage No. 19 (May 1974). 3. Voyage No. 20 (May-June 1974). 4. Voyage No. 28 (Oct. 1974). 5. Voyage No. 31 (Dec. 1974).



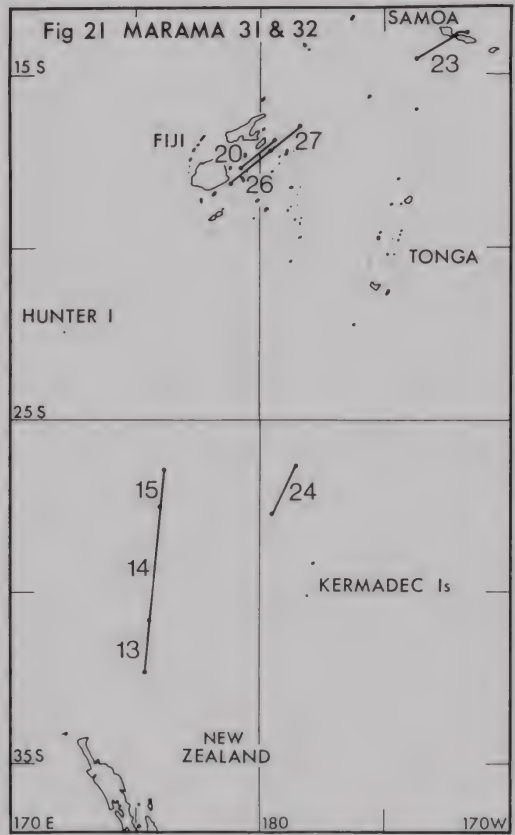
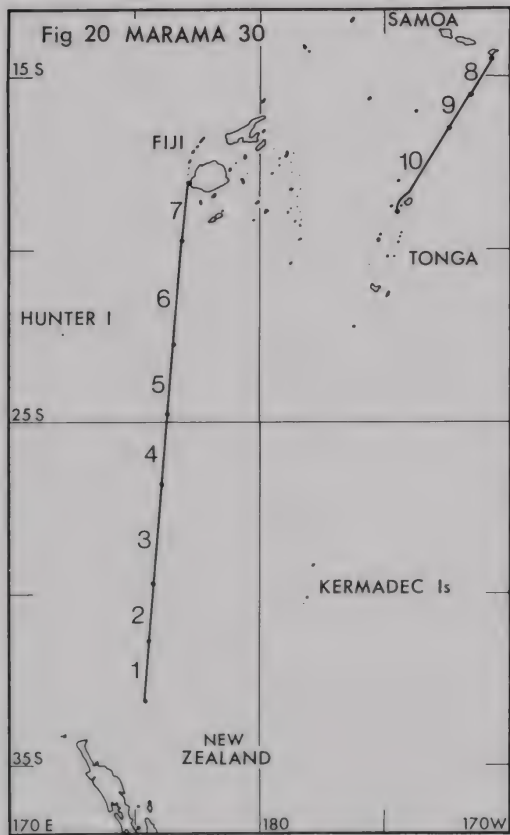
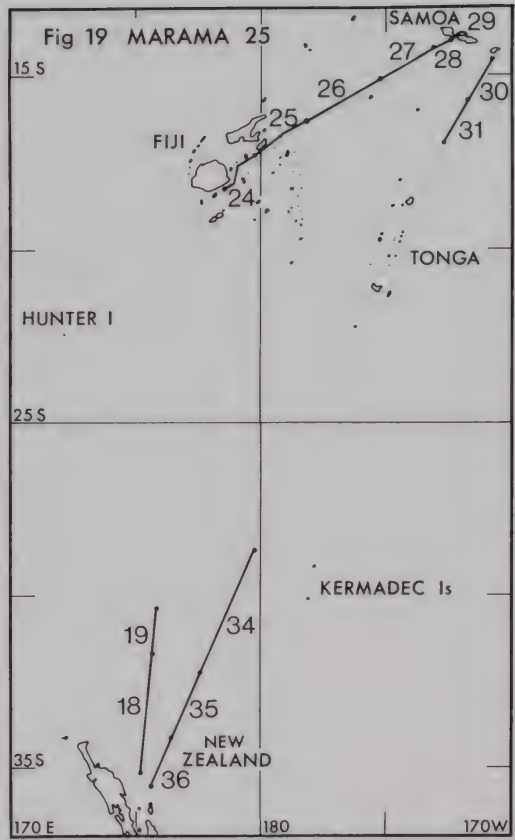
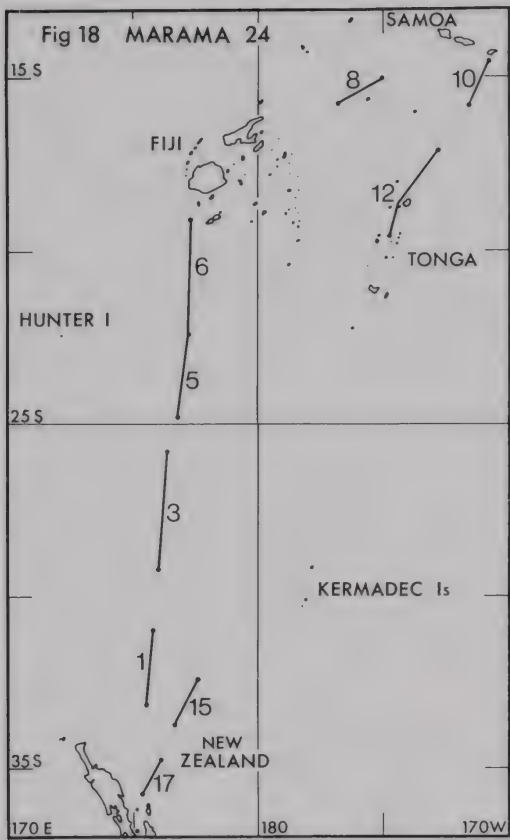
Figs. 6-9. Successful net runs and collections on *Union South Pacific* voyages. 6. Voyage No. 32 (Dec. 1974-Jan. 1975). 7. Voyage No. 35 (Feb.-March 1975). 8. Voyage No. 36 (March 1975). 9. Voyage No. 39 (May 1975).



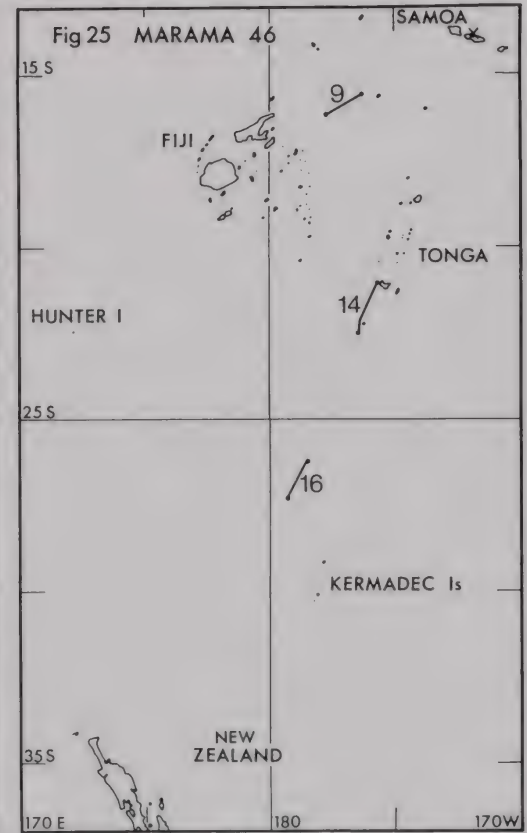
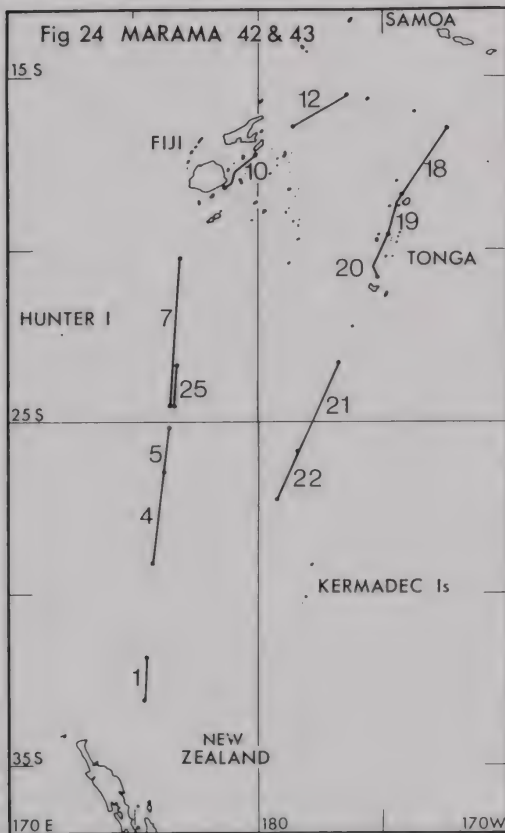
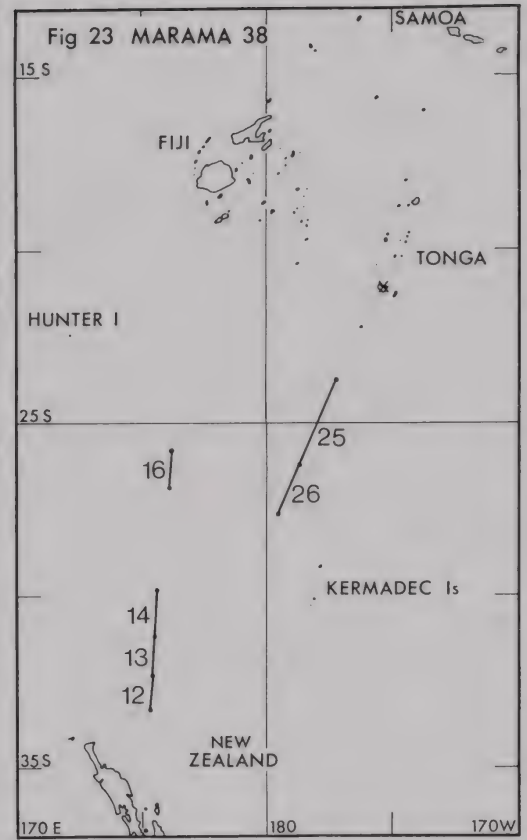
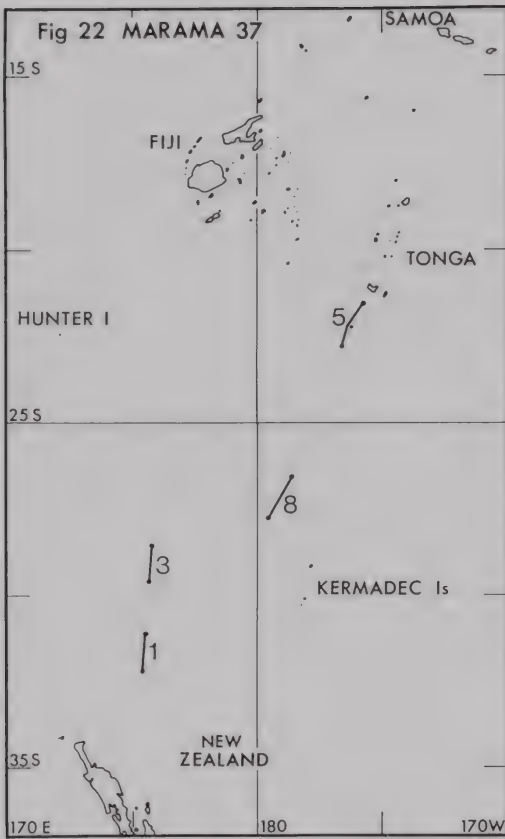
Figs. 10-13. 10. Successful net runs and collections on *Union South Pacific Voyage No. 40* (May 1975). 11-13. Successful net runs and collections on *Marama* voyages. 11. Voyage No. 1 (Jan. 1978). 12. Voyages No's. 4, 5 (March 1978). 13. Voyage No. 6 (March-April 1978).



Figs. 14-17. Successful net runs and collections on *Marama* voyages. 14. Voyage No. 10 (June 1978). 15. Voyage No. 11 (June 1978). 16. Voyages No. 12 (June-July 1978), No. 13 (July 1978). 17. Voyages No. 15 (Aug. 1978), No. 17 (Sept. 1978).



Figs. 18-21. Successful net runs and collections on *Marama* voyages. 18. Voyage No. 24 (Dec. 1978-Jan. 1979). 19. Voyage No. 25 (Jan. 1979). 20. Voyage No. 30 (April 1979). 21. Voyages No. 31 (April-May 1979), No. 32 (May 1979).



Figs. 22-25. Successful net runs and collections on *Marama* voyages. 22. Voyage No. 37 (July-Aug. 1979). 23. Voyage No. 38 (Aug. 1979). 24. Voyages No. 42 (Sept-Oct. 1979), No. 43 (Oct. 1979). 25. Voyage No. 46 (Dec. 1979).

ARTHROPOD FAUNA

Many bugs including aphids (Hemiptera), beetles (Coleoptera), moths (Lepidoptera), flies (Diptera), parasitic and social wasps and winged ants (Hymenoptera), and insect parts were taken in the nets. Also in the nets were psocids (Psocoptera), lacewings (Neuroptera), thrips (Thysanoptera), one small butterfly (Lepidoptera) and insect exuviae. A few wingless specimens, an ant (Hymenoptera), spiders (Araneae) and an amphipod (Crustacea), may have crawled into nets before they were set.

Many other specimens were hand collected on the ships, particularly after leaving New Zealand and after visiting ports in the Pacific Islands: earwigs (Dermaptera) a cockroach (Blattodea), bugs (Hemiptera), beetles (Coleoptera), moths and butterflies (Lepidoptera), flies (Diptera), parasitic and social wasps, a winged ant and a bee (Hymenoptera), spiders (Araneae) and a centipede (Chilopoda).

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The Auckland Museum Entomology Department project would not have been possible without the impetus and action of Captain J.A.F. Jenkins, who has continued the trapping of insects at sea over many years. John Jenkins has personally attended to the taking and care of samples and concurrent recording of data, and also to maintenance of nets and net rings. He has kindly checked data, re-drawn maps and answered innumerable questions, all of which assisted greatly in the production of this paper.

The use of Union Steamship Company ships for this project is also acknowledged. Mr N.G. Cheshire, Deck Officer, assisted by drafting original maps. Many crew members on the ships have assisted with the handling of nets and the collection of specimens.

Ms Caroline Phillips, Auckland, has prepared the figures for publication.

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